Name: ______________________ Date: ______________

Polynomial Operations SOLUTIONS (version 27)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -6x^5 - 8x^3 - 3x^2 - x - 10$$

$$q(x) = -8x^5 - x^4 + 9x^2 - 6x - 10$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-6)x^5 + (0)x^4 + (-8)x^3 + (-3)x^2 + (-1)x^1 + (-10)x^0 \\ q(x) &= (-8)x^5 + (-1)x^4 + (0)x^3 + (9)x^2 + (-6)x^1 + (-10)x^0 \\ p(x) + q(x) &= (-14)x^5 + (-1)x^4 + (-8)x^3 + (6)x^2 + (-7)x^1 + (-20)x^0 \\ p(x) + q(x) &= -14x^5 - x^4 - 8x^3 + 6x^2 - 7x - 20 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -6x^2 - 3x - 5$$

$$b(x) = -9x + 5$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-6x^2$	$-3x$	-5
$-9x$	$54x^3$	$27x^2$	$45x$
5	$-30x^2$	$-15x$	-25

$$a(x) \cdot b(x) = 54x^3 + 27x^2 - 30x^2 + 45x - 15x - 25$$

Combine like terms.

$$a(x) \cdot b(x) = 54x^3 - 3x^2 + 30x - 25$$

3. Express $(x + 1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 7x^3 + 29x^2 - 29x + 13 \\ g(x) &= x + 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 7 & 29 & -29 & 13 \\ -5 & & -35 & 30 & -5 \\ \hline & 7 & -6 & 1 & 8 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 7x^2 - 6x + 1 + \frac{8}{x+5}$$

In other words, $h(x) = 7x^2 - 6x + 1$ and the remainder is $R = 8$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 7x^3 + 29x^2 - 29x + 13$. Evaluate $f(-5)$.

You could do this the hard way.

$$\begin{aligned} f(-5) &= (7)\cdot(-5)^3 \ + \ (29)\cdot(-5)^2 \ + \ (-29)\cdot(-5) \ + \ (13) \\ &= (7)\cdot(-125) \ + \ (29)\cdot(25) \ + \ (-29)\cdot(-5) \ + \ (13) \\ &= (-875) \ + \ (725) \ + \ (145) \ + \ (13) \\ &= 8 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-5)$ equals the remainder when $f(x)$ is divided by $x+5$. Thus, $f(-5) = 8$.